Math 172 Spring 2011 Worksheet 2

1. A car is currently worth \$ 20000 and its value is decreasing by 15% per year. Write a difference equation for the value of the car t years from now, and find the general solution. How much will the car be worth in 10 years?

2. The population of a town is currently 2500 and it is decreasing by 10 people per year. Let $P(t)$ represent the population of this town t years from now.
a. Write a difference equation for $P(t)$ and find the general solution.
b. What population will this town have in 15 years?

3. A doctor determines that her patient needs the drug digoxin and prescribes a dose of 1 mg per day. However, the kidneys remove one third of the digoxin present in the patient's blood each day. Let $N(t)$ denote the amount of digoxin present in the blood after t days.
a. Write a difference equation for $N(t)$.
b. Assume that there is no digoxin present in the blood in the beginning of the process. Make a table of values for the amount of digoxin in the patient's bloodstream during the first week of taking the medication.
c. Assuming the patient continues to take the drug for a long time, what is the amount of digoxin in the bloodstream be in the long run?

4. The number of rabbits on an island is currently 600 and it is increasing by 8.5 % per year.
a. Write a difference equation for the rabbit population and find the general solution.
b. How long does it take for the rabbit population to double in size?
c. How long dow it take for the rabbit population to reach 2000?

5. Repeat problem **4.**, but this time use a differential equation instead of a differece equation (assume that the process is continous rather than discrete).

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6. A population $F(t)$ of fruitflies depends on time t. The initial population is $F(0) = 1000$ flies. The population is censused once every two weeks. Over this period, the natural rate of increase is 0.8%. At each census, 40 flies are removed from the population.

a. Write a difference equation that models this process. Note that in this problem we need to take a two week interval to be a unit of time.

b. Rewrite your equation as a recursive equation.

c. Find the size of the population after 4 weeks, and also after 20 weeks (use calculator).

d. Find the equilibrium value, decide whether it is stable or unstable, and predict the long term outcome of the population.

7. A population grows at a rate of 2% per year. Simultaneously, there is emigration of 12 million individuals per year.

a. Write the model equation for this process.

b. Find the equilibrium value and decide whether it is stable or unstable.

c. What will happen in the long run if the initial value is $A_0 =$ 200 million? Using a discrete model, how long does it take until the population becomes extict?

d. What will happen in the long run if the initial value is $A_0 = 700$ million? How long does it take until the population will reach 800 million?